of the same class have quite lately been placed on the South Saskatchewan; and it is proposed to employ these in the present emergency in carrying supplies from Medicine Hat, where this river is crossed by the Canadian Pacific railway, to the vicinity of Prince Albert.

This portion of the interior of the continent was reached in the days of the fur companies, either by the canoe route from Lake Superior, or by ascending the Nelson River from York Factory on Hudson Bay; and it was by the first-mentioned that Sir Garnett Wolseley, with his little force, penetrated to the valley of the Red River in 1870. When St. Paul had become a commercial centre, the Hudson-Bay company began to bring the greater part of its goods from the south; while in later years the police-posts, settlements, and cattle-ranches established in the far west were supplied from Fort Benton, on the Missouri. The Canadian Pacific railway, pushed with unexampled rapidity from Winnipeg across the plains, and completed to the summit of the Rocky Mountains about eighteen months ago, has, however, completely changed the old lines of travel. The time-honored trail from the Red River by Forts Carleton and Pitt to Edmonton — a journey of nearly nine hundred miles, requiring, with loaded carts or wagons, under the most favorable circumstances, nearly forty days — need no longer be followed. The points above mentioned, with other isolated little settlements of more recent date along the North Saskatchewan, are now reached by new trails from the nearest stations to the south on the railway; and a system of telegraph-lines, constructed and operated by the government, unites the more important of them. After leaving the railway, however, the distances to be traversed in the old-fashioned way, before the more remote settlements are reached, are still very considerable. Thus to Carleton and Prince Albert, from Qu'Appelle station, the trail-distances are 228 and 253 miles respectively; from Swift-Current station to Battleford, 202 miles; and from Calgary to Edmonton, 191 miles.

The length of this note does not admit of any detailed description of these and other main roads. It may be remarked, however, that while the trail from Qu'Appelle toward Carleton and Prince Albert, as far as the crossing of the South Saskatchewan, is generally through an open country, groves and belts of aspen are not infrequent in its vicinity. The longest stretch quite without timber is that known as the salt plains, about thirty miles only in width.

The country in the vicinity of Carleton, Prince Albert, and Duck Lake, is rolling, or characterized by low hills with numerous and in some cases extensive groves ('bluffs') of wood. The settlement is of a scattered character, but for the most part confined to the point of land between the two branches of the Saskatchewan, the total population being probably about three thousand.

At the crossing of the South Saskatchewan, by the trail from Swift Current to Battleford, there is a good ferry. This trail, to within about twenty miles of Battleford, is entirely destitute of wood. Battleford was at one time selected as the seat of government of the Northwest territory, but, since the definite location of the railway, has been abandoned in favor of Regina. There are scattered settlements of half-breeds and whites in the neighborhood, and several Cree Indian reserves. The trail from Calgary to Edmonton crosses the Bow, Red Deer, and Battle rivers, and several smaller streams flowing from the foot-hills and mountains. Ferries exist where necessary; and, should these not be destroyed, a rapid advance by this route would be easy. For sixty miles there is no wood on this trail: beyond that point timber is abundant. Edmonton is a somewhat important centre, with a number of little settlements of whites and half-breeds subsidiary to it. George M. Dawson.

THE GLOW-LAMP.

It was stated not long ago that the number of incandescent lamps in this country alone is over one hundred thousand. Such a success as this warrants a glance at the history of the lamp, which is given by A. Gelyi in the *London electrical review.*

While the arc-lamp emits twenty-two hundred candle-light per horse-power, and the glow-lamp gives but a hundred and twenty, it is the possibility of so reducing the light to a minimum that has brought the latter system forward; for, although it is true that the arc-light may be considered capable of a division into lamps of intensities varying from twenty to ten gas-flames, that minimum is in many cases, especially for domestic purposes, a great deal too high, whilst the regulating apparatus is expensive.

But two substances are known which possess such properties as are indispensable for the production of the glow-light; namely, platinum and its alloy with iridium, and, secondly, carbon. The former has the advantage, that, when heated to whiteness, it does not consume away even in the air: but, in a no less important respect, that metal is far behind carbon, for it is by no means capable of sustaining such a degree of heat without fusing; and this is of vital

importance, for the quantity of light emitted by a glowing substance rises in a more rapid proportion than the temperature of that substance.

In 1838 we find Professor Jobard of Brussels saying that "a small strip of carbon in a vacuum, used as a conductor of a current of electricity, would emit an intense, fixed, and durable light." De Changy, a former pupil of Jobard, seems to have taken these words as advice, for he commenced his experiments in that line almost immediately afterwards. About this time an Englishman named Moleyns also made an incandescent lamp by using platinum. De-Changy's experiments failed because the strips of gas-carbon which he used became disintegrated by the current, and, as his globes were not perfectly exhausted or sealed, the carbon gradually consumed away.

About the year 1843, J. W. Starr of Cincinnati entered upon a thorough study of the light, and found in Peabody a munificent promoter of his plans. After helping Starr in every way, Peabody sent him to England to exhibit his invention. Before starting on his voyage, Starr procured himself a companion named King, a shrewd man of business, who immediately had a large chandelier constructed with twenty-six electric glow-lamps, which were to symbolize the states of the Union. The novel spectacle was gazed upon by large crowds; and Faraday, after witnessing the experiments, signified to his American brother electrician his great satisfaction with the result.

Starr died on the return voyage, and King patented the lamp in his own name. This patent was granted on the 4th of November, 1845, and refers to 'a glowing carbon strip in a vacuum.' But with the death of Starr the necessary funds ceased to flow, and in a short time the promising glow-lamp was consigned to oblivion.

A very similar fate befell the inventions of the Englishmen Greener and Staite, who patented, in 1846, another carbon-lamp. Starr formed the necessary vacuum by using a tube thirty-six inches long, filled with mercury; but the generation of electricity was at that time far too expensive, although as regards the clearness of the light, and the durability of the carbon, the lamp was a success.

In 1849 Petrie proposed to patent the use of iridium, but the scarcity of that metal rendered it out of the question. In 1855 DeChangy resumed his studies with renewed zeal, occupying himself with the construction of a lamp in which platinum formed the conductor, and in 1858 patented a current regulator which enabled him to use his lamps for the illumination of mines, submerged for fishing-purposes, and in a nautical telegraph system by which signals were displayed from the mast-heads of vessels. The platinum was submitted to a preparing process of separation, being maintained heated for some time at a moderate degree of redness, and then gradually raised to that degree of heat to which it would be afterwards subjected in the lamp.

At intervals of ten and fifteen years after the inventions of Starr and of DeChangy, the incandescent lamp was revived, with partial success; but it was not until Edison and Swan put their shoulders to the wheel that a perfect and practical lamp was constructed.

In the year 1878 Edison was journeying in the Rocky Mountains, when a companion awakened within him the desire of occupying himself with electric lighting, and on his return to Menlo Park he furnished himself with the necessary apparatus. Like DeChangy, he imagined that it would be easier to use metal than carbon; and, with the abundant funds furnished him by the Edison electric-lighting company, he was enabled to reach almost every substance which his fertile brain might suggest. For instance: it is said that his attention was called to thorium, — a metal particularly difficult to fuse; and, when a mineralogist informed him that there was not a half-ounce of thorium in the whole territory of the United States, Edison called up one of his assistants, and, telling him that in one of the gold-mines of the north-west a quantity of monarite crystals (from which thorium is extracted) had been found, gave him a letter of credit, with instructions to bring him in the shortest possible time a hundred pounds of monarite. In a few weeks Edison had the monarite, and forthwith began his experiments. But thorium also failed; and platinum was again tried, this time with a certain amount of success.

Meanwhile the dynamo-machine and the Sprengel air-pump had been perfected. An Englishman named J. W. Swan now obtained fair results with a filament of charred cardboard, and found that the rapid consumption and consequent breaking of the glowing carbon was an almost insuperable impediment to his success, and he also found that the inner walls of his lamp became darkened by a deposit of some kind. These troubles must have been of a most alarming character. But Swan went on, and obtained the co-operation of a Mr. Stearn, who was considered a great authority as regards perfect vacuum. Evidently he also fully understood that the carbon must be previously heated to whiteness in a good vacuum; and in 1877 he sent to Mr. Stearn a quantity of carbonized cardboard strips, requesting that they be mounted in glass bulbs, subsequently to be exhausted as perfectly as possible. This seems to have been done with rare ability by raising the carbon to a very high degree of heat by means of an electric current, which set free the gases it contained, and afterwards removed them. The ends of the filaments were also made thicker; and when the connections were made good, and the vacuum sufficient, the glass bulb containing the glowing carbon did not blacken, and the consumption of the filament was infinitesimally small. There only remained to make the lamp mechanically perfect; and in 1878 Swan publicly exhibited his glow-lamp, which possessed all the essential characteristics of that in use at present. In the same year Edison discarded metals, and followed in the footsteps of the carbon men. Being forestalled by Swan, Mr. Edison could not use cotton thread in his lamp, and, after a long series of experiments, decided upon the use of filaments made out of a species of bamboo.